Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 AUG 2013	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Re: Coagulation and fluid resuscitation by HyperHES in severe hemorrhage. Response to Letter-to-the-Editor.	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Martini W. Z., Dubick M. A.,	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
United States Army Institute of Surgical Research,JBSA Fort Sam Houston, TX	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**1**	

more quickly the hypovolemic shock (small-volume resuscitation concept).

More importantly, recent data have suggested that hypertonic saline would modify coagulation less than a colloid only would.[4] In a model of hemorrhagic shock in pigs, resuscitation resulted in less impairment of clot formation when compared with administration of 6% HES or 4% gelatine.[4]

Contrary to isotonic crystalloids and colloids, which play only the ventricular preload, hypertonic saline also improves the other determinants of cardiac output, namely, ventricular afterload and inotropism.[5]

Finally, the volume of fluids needed to restore a good hemodynamics (mean arterial pressure, 65 mm Hg) is significantly different. By extrapolating the data by Martini et al., it would mean an average volume of 8,500 mL of lactated Ringer's solution for a man of medium weight (118 mL/kg). However, fluid resuscitation using HyperHES will start by an injection of 250 mL (recommended dose is 4 mL/kg).[2]

This last point seems not significant in a hospital context but is important in prehospital or war medicine. Indeed, in the setting of combat casualty care, the soldiers have to carry the first aid kit, and we cannot envisage to load them with so much weight.

In the context of trauma combat casualty care, fluid resuscitation by HyperHES, followed by normal saline infusion, seems to be an interesting option for both medical and tactical reasons.

*The authors declare no conflicts of interest.

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Re: Coagulation and fluid resuscitation by HyperHES in severe hemorrhage

In Reply:

We sincerely appreciate the interest in and comment from Drs. Vico, Dubost, and Merat regarding our article of "Comparisons of lactated Ringer's and Hextend resuscitation on hemodynamics and coagulation following femur injury and severe hemorrhage in pigs" published in the *Journal of Trauma and Acute Care Surgery*.

In our article, we reported that Hextend was effective in restoring hemodynamics and acid-base status with one-third volume of lactated Ringer's solution. However, this advantage was associated with undesired effects on coagulation possibly owing to greater and sustained hemodilution from Hextend resuscitation. Vico et al. reported that the French army uses HyperHES (a colloid and 7.5% saline) and suggested that HyperHES has the potential to be more effective in treating hypovolemic shock. We agree with their comments, since the effects on volume expansion have been reported in a large body of literature with 7.5% hypertonic saline as well as hypertonic saline with colloids such as dextran and hydroxyethyl starch.[1–4] However, we are unaware of studies evaluating the effects of HyperHES on coagulation after hemorrhagic shock. With well-documented effects of large molecular weight hydroxyethyl starch on coagulation and the findings of prolonged compromise in coagulation function from Hextend resuscitation in our study and by others in our group,[5,6] additional research effort is warranted to determine the effects of HyperHES on hemostasis under trauma and hemorrhagic shock. Perhaps, the lower molecular weight starch of HyperHES may have less effect on coagulation, but this will require confirmation. In addition, only 3% and 5% hypertonic saline solutions are approved by the US Food and Drug Administration, and HyperHES is not an approved product available in United States. Although the US military would like such a product for resuscitation, the military's Tactical Combat Casualty Care Committee could only recommend Hextend as a lower-dose plasma volume expander for far-forward use.[7] Thus, it is unlikely that a recommendation can be made for HyperHES for US combat casualty care in the near future, but we appreciate Dr. Vico and his colleagues bringing this product to our attention.

*The authors declare no conflicts of interest.

The opinions or assertions contained herein are the private views of the author and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

The study that this letter refers to has been conducted in compliance with the Animal Welfare Act, the implementing Animal Welfare Regulations, and the principles of the Guide for the Care and Use of Laboratory Animals.

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